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SOMETHING ABOUT JELLY-FISHES.

BY EDWARD S. MORSE.

PLATE 8.

THE loiterer by the sea-side may have noticed in his rambles on the beach, certain gelatinous substances left by the retreating tide. An interest excited by so strange a sight may have prompted a closer examination, and yet recognizing nothing tangible or definite in the structure of these shapeless bodies, a desire has been really awakened to know something about them. We will try to satisfy this curiosity, by giving a brief account of a few of our more common Jelly-fishes; for these shapeless lumps of jelly, seen stranded on our beaches, are really animals, assuming the most graceful and symmetrical forms in the water.

The Jelly-fishes, or Medusæ, have long excited the attention of naturalists from their singular structure, and the wonderful changes occurring during their growth.

While in the higher expressions of animal life the anatomist may puzzle over the intricacies of a complicated organization in the Jelly-fishes, he is at first more perplexed to find anything like organization in their parts, though they are really highly organized compared with animals still lower in the scale. So transparent are some, that one can hardly detect their presence in the water, and so largely does the sea-water enter into their composition, that certain kinds when dried lose ninety-nine one hundredths of their own weight.

Peron and Lesueur, two distinguished French naturalists, who, in the early part of this century made a voyage around the globe, thus summed up the results of their combined observations on these animals. "The substance of a Medusa is wholly resolved, by a kind of instantaneous fusion, into a fluid analogous to sea-water; and yet the most important functions of life are effected in bodies that seem to be nothing more, as it were, than coagulated water. The multiplication of these animals is prodigious, and we know nothing certain respecting their mode of generation. They may acquire dimensions of many feet in diameter, and weigh, occasionally, from fifty to sixty pounds; and their system of nutrition escapes us. They execute the most rapid and continued motions; and the details of their muscular system are unknown.

"Their secretions seem to be extremely abundant; but we perceive nothing satisfactory as to their origin. They have a kind of very active respiration; its real seat is a mystery. They seem extremely feeble, but fishes of large size are daily their prey. One would imagine their stomachs incapable of any kind of action on these latter animals: in a few moments they are digested. Many of them contain internally considerable quantities of air, but whether they imbibe it from the atmosphere, extract it from the ocean, or secrete it from within their bodies, we are equally ignorant. A great number of these Medusæ are phosphorescent, and glare amidst the gloom of night like globes of fire; yet the nature, the principle, and the agents of this wonderful property remain to be discovered. Some sting and inflame the hand that touches them; but the cause of this power is equally unknown."

Professor Richard Owen quotes these "lively paradoxes" to show the progress made since then in clearing up many points that were obscure at their time, and to show that even the skilful naturalist, with abundant material at hand, may plod on with uncertainty unless aided by the higher powers of the microscope. Recent works published by

Professors Agassiz and Clark, and Mr. A. Agassiz, have detailed very fully the anatomy and classification of our native species.

The Jelly-fishes of our coast are represented by numerous globular and disk-like animals of a gelatinous texture, more or less transparent, having certain appendages consisting either of longitudinal bands of vibrating fringes, as in one order; or, as in another order, having appendages surrounding the mouth, and others, thread-like, hanging from the margin of the disk. The parts most conspicuous within the body are the ovaries, or egg-sacks, the stomach, and certain tubes running from the stomach to the periphery of the body.

These animals are apparently radiated in their structure; at all events, it is difficult in certain groups to distinguish a right and left side, and for this reason they are called Radiated animals, and form one of the three classes of the branch RADIATA.

The Jelly-fishes of our coast are common in our harbors and inlets, where the water is fresh and pure from the ocean. A very ready and convenient way to collect them is to moor your boat on the shady side of a wharf where the reflected rays of the sun are avoided, and, as the tide sweeps gently past, to dip them as they are borne along by the current. Some little practice is necessary to discern the smaller kinds, for many species are very minute, and other species, though of good size, are nevertheless hard to distinguish on account of their extreme transparency. They may be dipped from the water with a tin dipper, though a wide-mouthed glass jar is better for this purpose. As they are secured, they may be poured into a wooden pail for assortment and examination at home; or, better, a large glass jar, carried on purpose to hold them, may be filled at once, as too frequent changes destroy them.

Some species are very hardy, and may be kept alive for weeks, while others live only a few hours, gradually diminishing in size till they appear to melt away in the water.

Among the more common forms met with on our coast is the *Pleurobrachia* (Plate 8, Fig. 8). Words fail in describing the beauty and singularity of this Jelly-fish. Conceive a globular body the size of a walnut or larger, but perfectly transparent, having eight bands of rapidly vibrating fringes surrounding the body, running from one pole to the other like the ridges on a walnut, and two thread-like appendages, festooned with hundreds of shorter threads, trailing out behind the body like the tail of a comet, and you have a general idea of this Jelly-fish.

The zones of vibrating fringes act like so many little oars, and impel the body through the water. At times, only the fringes on one side are in motion, and then the body rotates in the water like a vital globe. Anon, the different zones alternate in action, and the body describes a spiral course in the water. The most beautiful prismatic hues are exhibited when these fringes are in motion, and these brilliant changing colors often lead to their detection in the water. The long thread-like appendages, already mentioned, are the most wonderful portion of the structure of this Jelly-fish. They are lined with hundreds of smaller threads which start at right angles from the main threads, and are all of the extremest tenuity. The distance these appendages can be projected from the body, the instantaneous manner in which they are drawn within the body, and the perfect control the animal manifests in their movements seems incredible, until the movements have been actually witnessed. When contracted, these appendages occupy a space of exceeding minuteness, and when projected from the body seem to run out as a cable runs from a ship. We have sought in vain for any definite solution of the function of these threads, and are compelled to offer one derived from our own observations. Beside the locomotive power derived from the longitudinal zones of fringes, the body will be seen to oscillate to and fro, this motion being produced by the alternate contraction and relaxation of these threads, the resistance offered to the water by the sudden contraction of the expanded threads being sufficient to oscillate the body. The Jelly-fish in question, unlike most members of the class, swim with the mouth upward, and the appendages start from the pole opposite the mouth; and since the mouth is unprovided with any organs whereby to grasp food, the mouth has the power of sweeping back and forth in the water by the oscillations of the body, affording greater chances of coming in contact with their food. It has the power of seizing little shrimp-like animals, and a singular sight it is to see this Jelly-fish, with its repast perfectly visible within its transparent body.

There are two other forms of Jelly-fishes not uncommon in our waters, which have the zones of locomotive fringes, but have no trailing appendages, as in the species just described. One of these forms is called Bolina, and is somewhat larger than Pleurobrachia, being pear-shaped, and the larger end divided into two lobes which surround the mouth. These lobes have the power of expanding and contracting, and the contour of the animal is materially altered by their movements. They may sometimes be seen gaping wide, disclosing the mouth, and ready to entrap its food, and again so contracted that the mouth is quite hidden.

Another form called *Idyia* is long and cylindrical like a tube rounded and closed at one end, the other abrupt and open; the open end constitutes the mouth. In fact, it is hardly more than a locomotive stomach. This Jelly-fish has more consistency than those heretofore described, and is quite opake. At certain seasons of the year they are pinkish in color. An individual of this species, when confined with Pleurobrachia, soon manifests its carnivorous propensities by attacking, and often swallowing the Pleurobrachia whole. It does not appear daunted if its victim proves larger than itself, but slowly, patiently engulfs its victim; and a curious sight it is to see the Idyia directly after this feat is performed, presenting the appearance of a tight skin drawn around the innermost Jelly-fish, though in a short time its food is digested, and the Idyia resumes its normal shape, and not in the least augmented in size. It probably requires a dozen or more of such game for an ordinary lunch. This statement will not be wondered at, if the experiment is tried of drying a specimen of Pleurobrachia on a white card, and finding nothing left but a few crystals of salt. The vitality of these Jelly-fishes is remarkable: they can be cut in several pieces, and yet each piece will remain alive for a long time in the water; and one naturalist, after having cut an Idyia in half longitudinally, observed one half to enfold, and digest another Jelly-fish.

The three forms thus far described are common representatives of an order of Jelly-fishes called *Ctenophoræ*, or Comb-bearers, the fringes or paddles having been compared by some writers to the teeth of a comb. These fringes form a distinguishing trait of the order. The members of this order are reproduced directly from eggs.

We will now consider another order of Jelly-fishes called *Discophoræ*, or disk-like Jelly-fishes, since the form of many species present a disk-like appearance. Members of this order are very conspicuous in the water, owing to their large size, their opacity, and the distinctness of their egg-pouches. They have no zones of locomotive fringes, but hanging below the disk and surrounding the mouth are numerous appendages, and surrounding the border of the disk is seen a delicate fringe of threads interrupted at regular intervals by little dots called eyes. These Jelly-fishes swim in the water by successive expansions and contractions of the disk, making a motion something like the motion made by the partial closing and opening of an umbrella. This motion is very leisurely performed, and the animal appears drifted by the currents and eddies with but little power to direct its course.

Our most common species, the *Aurelia* (Plate 8, fig. 5), occurs abundantly in our bays, sometimes in vast multitudes. When full-grown they measure from twelve to fifteen inches in diameter.

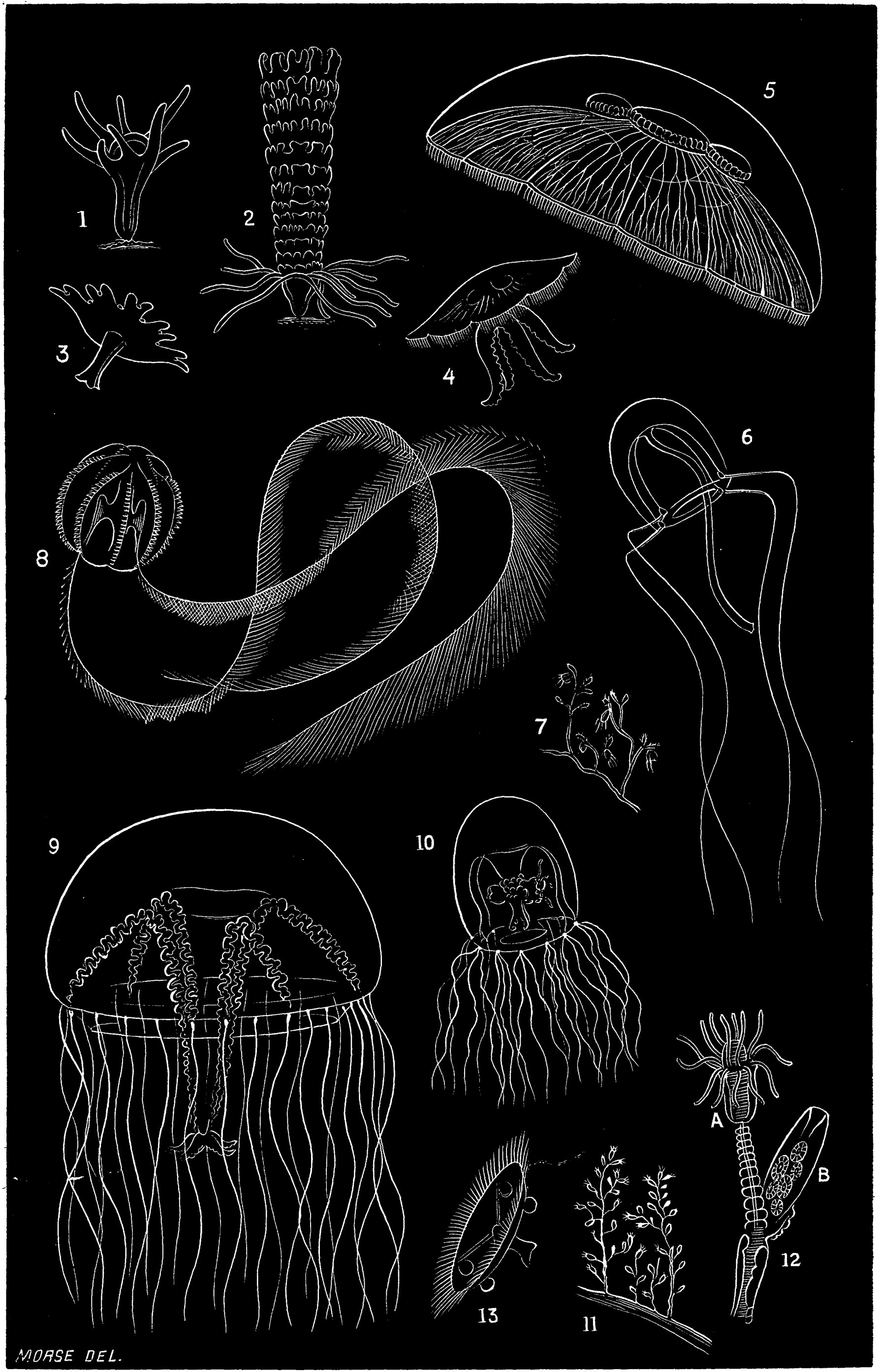
Another form, called *Cyanea*, often attains an immense size. Mr. A. Agassiz gives an account of one that measured seven feet across the disk, and whose appendages stretched out to the length of one hundred and twelve feet; their average size, however, is about one-third the dimensions just given.

The nettling sensation produced by certain Jelly-fishes, when brought in contact with the naked body, has long excited the attention of naturalists. The Cyanea is one of the most formidable in this respect, and Prof. Edward Forbes describes an English species as "the terror of tender-skinned bathers. With its broad, tawny, festooned, and scalloped disk; often a full foot or more across, it flaps its way through the yielding waters, and drags after it a long train of riband-like arms, and seemingly interminable tails, marking its course when the body is far away from us. Once tangled in its trailing 'hair,' the unfortunate, who has recklessly ventured across the graceful monster's path, too soon writhes in prickly torture. Every struggle but binds the poisonous threads more firmly round his body, and then there is no escape; for, when the winder of the fatal net finds his course impeded by the terrified human wrestling in its coils, he, seeking no combat with the mightier biped, casts loose his envenomed arms, and swims away. The amputated weapons, severed from their parent body, vent vengeance on the cause of their destruction, and sting as fiercely as if their original proprietor itself gave the word of attack." Peculiar oval cells, each containing a little filament capable of protrusion, have been supposed to be the seat of this nettling sensation. These are called urticating cells, and the whole class of Jelly-fishes are called *Acalephs*, or Sea-nettles, from this peculiar property. These stinging cells cover the surface of the body and appendages, though, strange enough, there are many species possessing these cells that produce no stinging sensation whatever.

The strangest feature in the history of certain Jelly-fishes belonging to the order Discophoræ, as the Aurelia, for instance, is their wonderful mode of reproduction. It would require too long a time to detail the successive steps made before the whole truth was known regarding the development of these Jelly-fishes. How the successive stages were described by different zoölogists as entirely distinct animals, until at last it was proved that they all represented the different stages of growth of one animal. The Aurelia, for example, gives origin to little locomotive eggs; these, swimming in shoals, finally effect lodgments on the rocks, one end becoming attached, and the other throwing out little tentacles as in Fig. 1, on Plate 8. In this condition they resemble miniature Polyps. Gradually they increase in length, and little transverse seams, or constrictions, appear on the sides of the body, these constrictions deepening, and their edges becoming scalloped. (See Plate 8, fig. 2.) Finally, the seams have deepened to such an extent that their appearance have been compared to a pile of saucers, and at last they become separated one after the other, each turning upside down, and swimming off free Jelly-fishes. In this stage they are called Ephyra, and are entirely unlike their parent in appearance. By the fall they will have attained their adult form, and a diameter of twelve or more inches.

Figs. 3, 4, on the Plate, represents Ephyras in different stages of growth, a short time after separating from the stalk. In spring time the water is alive with them.

By far the greater number of our smaller Jelly-fishes belong to another order called *Hydroids*, and pass through phases of growth equally as strange as those above recounted. The limits of our paper will allow only a few words on this group. On the rocks at low water, and on floating weed, little moss-like tufts will be found in abundance. This plant-like growth, when examined under a lens, will be seen active with life. The ends of the little twigs and offshoots appear as little bell-shaped cups, with tentacles studding the free ends like the plates of a flower; these are the fixed individuals, and are the purveyors of the community. In the spring time little capsules will be noticed on the twigs, within which are



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to be seen minute globular bodies, to be finally set free by the rupture of the capsule, as free swimming Jelly-fishes. (See Plate 8, fig. 12: *a*, fixed individual; *b*, capsule containing young Jelly-fishes.) Others bud directly from the twig and drop off singly, as in *Coryne*. (Fig. 7, buds forming from Hydroid stalk; Fig. 6, adult Coryne.) These are found by thousands in spring time. Not only do these free Jelly-fishes bud from fixed communities, but in one species young ones bud from the Jelly-fish itself, as in *Lizzia* (Fig. 10), and certain others where the young bud from the stomach. All these Hydroid Jelly-fishes produce eggs, which again give rise to plant-like communities. At another time we hope to devote a chapter to the structure of Jelly-fishes, and illustrate more fully the character of the Hydroids, of which we have scarcely touched in this paper.

EXPLANATION OF PLATE 8.

Fig. 1. Early condition of *Aurelia*,—after AGASSIZ.
Fig. 2. Older condition of same, showing individuals about to separate,—after AGASSIZ.
Fig. 3. *Aurelia*, a short time after freeing itself,—original.
Fig. 4. Advanced stage of above,—original.
Fig. 5. *Aurelia*, in adult condition,—after AGASSIZ.
Fig. 6. *Coryne mirabilis* Ag.,—original.
Fig. 7. Hydroid community of *Coryne* magnified, showing Jelly-fish buds about to separate,—after CLARK.
Fig. 8. *Pleurobrachia*,—after A. AGASSIZ.
Fig. 9. *Tima formosa* Ag.,—original.
Fig. 10. *Lizzia grata* Ag., showing young ones budding from stomach,—original.
Fig. 11. Hydroid community of *Eucope diaphana* Ag.,—after A. AGASSIZ.
Fig. 12. Showing one twig of *Eucope* with fixed individual A, and reproductive capsule B, containing a number of young Jelly-fishes,—after A. AGASSIZ.
Fig. 13. *Eucope*, in adult condition, magnified,—original.